Review 8 Implicit Differentiation

Want derivative but x's & y's are together

1. take der of each term
2. collect all terms containing $\frac{dy}{dx}$
3. factor $\frac{dy}{dx}$
4. solve for $\frac{dy}{dx}$

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tips

1. if the term contains y the derivative should contain a y' (chain rule)
2. if you have a product or quotient in a term use product or quotient rule
3. der. of $y^n = n y^{n-1} \cdot y'$

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Ex 1. $x^2+y^2=2y^3$ find $\frac{dy}{dx}$

$2x + 2yy' = 6y^2 y'$

$2x = 6y^2 y' - 2y \cdot y'$

$2x = y'(6y^2 - 2y)$

$\frac{2x}{6y^2-2y} = y'$

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Ex 2. $xy^2+2y^4=x^2y$

Find the tan & normal lines at (2,1)

$x \cdot 2y \cdot y' + y^2 + 8y^3 y' = x^2 y' + y \cdot 2x$

$2 \cdot 2 \cdot 1 \cdot y' + 1^2 + 8 \cdot 1^3 \cdot y' = 2^2 y' + 1 \cdot 2 \cdot 2$

$4y' + 1 + 8y' = 4y' + 4$

$8y' = 3$

$y' = \frac{3}{8}$

tan: $y = \frac{3}{8}(x-2)+1$

Normal $y = -\frac{8}{3}(x-2)+1$

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Ex 3 $2x^3 - 3y^2 = 8$ find $\frac{d^2y}{dx^2}$

$6x^2 - 6y \cdot y' = 0$

$y' = \frac{-6x^2}{-6y} = \frac{x^2}{y}$

$y'' = \frac{y \cdot 2x - x^2 y'}{y^2} = \left(\frac{2xy - x^2 \cdot \frac{x^2}{y}}{y^2}\right) y$

$y'' = \frac{2xy^2 - x^4}{y^3}$

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